Demand for Niche Local Brands in the Fluid Milk Sector

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[Preliminary and Incomplete]

1. Introduction

The demand for local products has grown considerably over the last decade. The growing trend of local has drawn much research attention in fruits and vegetables, but little research has been done in the milk sector. In particular there has been a growing interest in locally branded milk that reaches a niche market where farmers are able to integrate their raw milk production with processing and/or distribution of product to retailers for consumption. Two studies that have approached the issue of local milk focus on proximity to production facility or varying local definitions as opposed to specific branding strategies. With a choice experiment through an online survey of U.S. consumers in 2008, Wolf, Tonsor, and Olynk (2011) find that consumers are willing to pay about 10 percent more for "locally" branded milk, however, they do not define local instead leaving it to the subjective definition of the survey taker. Kovalsky and Lusk (2013) also do an online survey to determine the willingness to pay for milk in the Midwest and South. Their research finds that consumers are willing to pay between $0.46 and $1.55 per gallon, depending on how far the milk travels greater than 25 miles from the store, but this does not address questions about branding. Therefore, the existing literature does not fully explain the demand of locally branded milk. Heterogeneity of consumer preferences and marketing strategies can also influence the valuation of local milk. Furthermore, the methods used by existing literature do not consider actual behavior which can be observed using purchase data.

The limited understanding of local milk demand draws our interest to estimate a demand analysis incorporating marketing strategies and allowing consumer preferences to be heterogeneous. Specifically, we are interested in the effects of nutritional factors, prices, packaging size and characteristics, distribution channel, and horizontal brand extension on consumers' choices of locally branded milk. Moreover, these effects vary among consumers due to their demographic and attitudinal differences.

2. The Local Milk Market

In the dairy sector, due to the relatively limited transportation range and the perishable feature of raw and processed milk, fresh fluid milk has a regional production focus. However, the branding of processed fluid milk most often does not take the dairy farmer label and thus often loses the “local” marketing label. Unlike fruits and vegetables where the harvested product is also a finished consumer product, fresh fluid milk sold in supermarkets must first go through a homogenization and pasteurization process prior to bottling for consumer sale. Thus the raw milk harvested by a dairy farmer is shipped to processing plants, most often via dairy cooperatives like Agri-Mark in the northeast. The milk is then processed, packaged and labeled with national brands, private label store brands, and local brands. At the national brand level, Dean Foods, the leading dairy processor in the United States, processes and bottles roughly 70 percent of the northeast regions fresh fluid milk under the name Garelick Farms and a variety of other national brands and private label store brands. HP Hood, another national brand, bottles about 20 percent of the regions fresh fluid milk. Thus 90 percent of the fluid milk sold in the northeast moves through these two processing companies.

Some of the remaining milk in the northeast region is produced and processed by smaller local brands. For example, Farmer’s Cow and Mountain Dairy in Connecticut, Rhody Fresh in Rhode Island, and Our Family Farms and High Lawn Farm in Massachusetts, just to name a few. All of the other northeast states also have local brands that produce, market, and distribute their own finished fluid milk product. By branding their own milk these farms create a connection between the farm and consumer and an opportunity for long term sustainability while also helping other local businesses (Felson, 2013). With the growth of the local food movement it is essential for the success of these farms to understand the local food consumer and what types of marketing practices might be more effective in stimulating consumer demand.

However, in practice, local brand milk can be priced by retailers at up to 40 percent more than private label store brand milk and comparable to the price of private label organic milk. A price differential this large can create difficulties for local brand milk to compete with national and private label brands. Thus local dairies need to find alternative marketing strategies to be competitive in the dairy case. Table 1 summarize the list of local brands used in this analysis which covers major local milk brand exited in northeast region.

3. The Model

3.1 The Basic Demand Analysis of Local Milk

We first analyze the demand of local milk to understand the competition between local milk and other milk products. We define a milk product is a combination of its brand, butterfat content and container size. For example, a one-gallon whole milk of Hood and a half-gallon whole milk of Hood are considered as two different products. We further label theses milk product into three types: national brand, local brand and private labels. Local brand are products that are produced, processed, and distributed by local farms and they brand their own finished fluid milk products in the market. For example, the Farmer's Cow is a group of six Connecticut family-owned farms and they brand their finished products as Farmer's Cow in the market. National brands are products that are produced by mass processing plants sharing the same name regionally or nationally. For example, Garelick Farms processed by Dean Foods is considered as national brand even though the milk may also be produced by local farms. Private labels are store brand.

Following Berry, Levinsohn, and Pakes (1995;hereafter BLP), we assume in each market consumer choose one milk products among all available alternatives to maximize utility driven by product characteristics as well as the consumer's own characteristics. The total number of milk products on market *m* is *J* and there are *M* markets. Then the indirect utility of consumer *i* from buying milk product *j* in market *m* is given by

$$U_{ijm} = \alpha_i p_{jm} + \beta x_j + \Phi_{1,i} Local_{jm} + \Phi_{2,i} National_{jm} + \xi_{jm} + \varepsilon_{ijm} \qquad (1)$$

$$, i = 1, \dots, n; j = 1, \dots, J; m = 1, \dots, M$$

Where p_{jm} is the price of product j in market m and x_j is a vector of fat content and container size dummy variables of product j. We collect information of four fat content categories: whole, 2%, 1% and fat free. As for container size, we just focus on gallon and half gallon milk which are the most common sizes in the market. We assume there is no heterogeneity in consumers' preferences to fat content and size characteristics since those are not characteristics we are interested in[1].

[1] To check the assumption validity, we still did the regression allowing heterogeneity in these characteristics and results do not change a lot compared with the model without heterogeneity. Thus, to simplify the computation process, we assume there is no consumer-specific preference to milk fat content and size.

Therefore, α_i is consumer-specific taste parameters to price and β is consumers' common taste parameter to fat content and size characteristics. $Local_{jm}$ and $National_{jm}$ are a dummy variable indicating brand type of product j in market m. Therefore, $\Phi_{1,i}$ and $\Phi_{2,i}$ are our main interest which are consumer-specific taste for local brand products and national brand products compared with private labels. ξ_{jm} is unobserved product characteristics and ε_{ijm} is a stochastic term with zero mean and is distributed independently and identically as a type I extreme value.

To incorporate the consumer factors influencing product choice, consumer-specific taste parameters are decomposed into observed consumer characteristics (D_i) and unobserved consumer characteristics (v_i). The observable consumer characteristics are household income. The unobservable consumer characteristics are assumed to have a standard multivariate normal distribution. Thus, the taste parameters can be expressed as

$$\alpha_i = \alpha + \lambda D_i + \gamma v_i \tag{2}$$

$$\Phi_{1,i} = \Phi_1 + \varphi D_i + \rho v_i \tag{3}$$

$$\Phi_{2,i} = \Phi_2 + \tau D_i + \pi v_i \tag{4}$$

Then the indirect utility can be decomposed into three parts written as

$$U_{ijm} = \delta_{jm} + \mu_{ijm} + \varepsilon_{ijm} \tag{5}$$

where (1) δ_{jm} is the mean utility term and $\delta_{jm} = \alpha p_{jm} + \beta x_j + \Phi_1 Local_{jm} + \Phi_2 National_{jm}$, which is common to all consumes. (2) μ_{ijm} is brand-specific and consumer-specific deviation from the mean and $\mu_{ijm} = \lambda D_i p_{jm} + \gamma v_i p_{jm} + \varphi D_i Local_{jm} + \rho v_i Local_{jm} + \tau D_i National_{jm} + \pi v_i National_{jm}$, which is the interaction between consumer and product characteristics. (3) ε_{ijm} is stochastic term with zero mean and is distributed independently and identically as a type I extreme value.

Therefore, the probability that consumer i choose a unit product j in market m is

$$s_{ijm} = \frac{\exp(\delta_{jm} + \mu_{ijm})}{1 + \sum_{r=1}^{J} \exp(\delta_{rm} + \mu_{irm})}$$

and aggregate over consumers, the market share of product j in market m is corresponding to the probability product j is chosen in market m which is approximated[2] as

$$s_{jm} = \frac{1}{ns}\sum_{i=1}^{ns}\frac{\exp(\delta_{jm} + \mu_{ijm})}{1 + \sum_{r=1}^{J}\exp(\delta_{rm} + \mu_{irm})}$$

Following BLP, we matched the predicted market share with observable share and solve the model using generalized moment method. The estimated coefficients can reveal the consumer's preferences towards the local brand milk.

4. The Data

We use Nielsen Retail Scanner data to collect the fluid milk products' characteristics including prices, brand description, fat content, and package size. The Nielsen Retail Scanner data collect information from approximately 35,000 participating grocery, drug, mass merchandiser, and other stores in all US markets. Since local brands usually have limited market in terms of geographic scope, we only focused on Massachusetts and Connecticut which share most of brands. The extracted data are from January 1, 2006 to December 31, 2011. We restrict our analysis to the top 7 national brands and top 9 local brand, which account for over 98% of total milk sales in these two states. Thus, combined with four fat content categories and two types of package size, 94 products are defined in our analysis[3].

In this analysis, a market is defined as month-county combination. The potential market size is defined for each period and county as population of the county times the combined per capita consumption (in volume) of milk plus other beverages including water, tea, and fruit juice. Then the market share for each product is calculated as sales volume divided by the potential market size.

Table 2 provides the descriptive statistics of major product characteristics used in this analysis. Retail prices are computed as sales weighed price for a product sold in a specific market. The average price for all milk in one county is 0.033$/oz. Of all milk products available on the market,

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[2] See Nevo (2000)

[3] However, the data is unbalanced in terms of each market. Thus, not all 94 products show in every market.

54% of them are national branded, 25% are private label and19% are local brands. Fat content and package size information are obtained directly from the database. Almost half of the products are one gallon. To compare the difference between brand types, Table 3 shows the product characteristics by brand type.

We further break down our sample by brand type and Table 3 presents the summary statistics of the subsamples. Compared with private label and national brand milk, local brands has the highest price. In terms of market shares, private label milk clearly dominate the market with an average share of 0.493% in a market, followed by national brands. Local milk, however, only takes a small share, around 0.007%. As for fat content, national brands tend to have more fat free milk and less whole milk, while local milk brands tend to carry more whole milk. One major difference in product offering between local milk and their competitors are the container size. Only a small proportion of local milk (28%) are offered in gallon-size container on the market (see Table 3), while around 50% of private label and national brand milk are offered in gallon-size container.

Consumer characteristics for Massachusetts and Connecticut are obtained form 2010-2014 American Community Survey from U.S. Bureau of Census. For each market, 100 observations on income are drawn to match the data of milk purchase. The sample average is 8510 for household/month, which quite close to the average from 2010-2014 American Community Survey.

Instrumental variables are used to address the potential endogeneity problem of product price. Input prices including Class I milk price, wages, price of electricity, price of plastic are the first set of instrument variables to proxy cost shifters. The second set of instrumental variable is Hausman (1994) type instruments, e.g. prices of the same brand in other markets, which is correlated to the price in this markets because of common production cost but uncorrelated with unobservable market-specific demand shocks.

5. Empirical Results

5.1. The basic analysis of consumers' preference toward local milk.

Table 4 represents the estimated demand parameters of local milk. Price negatively affect consumers mean utility and it does not show significant heterogeneity among consumers.

Consumers prefer less local milk than private labels and income does not significantly influent the corresponding consumer-specific tastes. However, the heterogeneity of consumer preference for local milk is significant coming from other unobservable factors. Similarly, consumers' mean utility also respond negatively to national brand compared with private labels, which diminishes with higher income. As for the fact content, consumers significantly prefer more whole milk and 1% milk than 2% but less fat free milk than 2% on average. In terms of package size, one gallon is significantly preferable than half gallon for most consumers.

5.2 Simulations of different marketing strategies for local brands.

The estimated parameters in the demand equation allow us to capture how price, local feature, package size and butterfat content affect consumers' demand and choices of fluid milk. This section considers the effects of alternative marketing price on local milk consumption by simulating the market outcome under different scenarios, over the sample period. Specifically, we conduct the following three sets of simulations to examine how consumers' consumption of local milk might be affected by different marketing and firm practice, which changes the characteristics of milk products in consumers' utility function:

1) Price cut of local milk: we impose a 10% cut on local milk.
2) New package offering: we switch all half-gallon container to one-gallon container for local milk.

Using the demand estimates, we recalculate the new market shares using the changed product characteristics under different scenarios. The results of conducted marketing practice simulations to examine how local milk consumption might be affected by the three scenarios are shown in Tables 5 and 6. In particular, we assessed the percentage changes in market shares of the fluid milk market. These changes translate directly into changes in consumption since the market size of all beverages (the denominator of market shares) remained fixed by design.

Table 5 presents the overall impact on different milk categories. Prices of local milk are generally higher than their private label and national brands counterparts. To examine the prices are the main reasons that prevent consumers from purchasing local milk, we reduce the prices of local milk brands by 10%, which will bring down the prices of local milk to an equivalent level of their competitors. The results suggest that, the 10% price cut will promote the sales of local milk, but only by around 5.697%. On the other hand, the sales private label milk and national brands milk will be negatively impacted. However, the impact is minimum, only 0.019% less for private label milk and 0.023% for national brand milk.

Column 2 of Table 5 presents the simulation results when switching all half-gallon container to one-gallon container for local milk. The consumption of local milk go up substantially by almost 80% when offer gallon-size milk. This results is reasonable since most consumers prefer to buy milk in gallon-size container according to our demand estimation results in Table 4. However, only a small proportion of local milk (28%) are offered in gallon-size container on the market (see Table 3), while around 50% of private label and national brand milk are offered in gallon-size container. Therefore, it is possible for local milk to see a strong growth in sales if they offer more 1-gallon container options. However, it is worth to notice that, the local milk only take a considerably small market share in the fluid milk market, even with an 80% growth in sales. As suggested in Table 3, the market share of local milk in the beverage market is only 0.007%, with 0.495% for private label milk and 0.103 for national brand milk.

Table 1. Local Brands in MA and CT markets

Local Brand	Headquarter State
GUIDA'S	CT
MARCUS	CT
THE FARMER'S COW	CT
BYRNE DAIRY	MA
HIGH LAWN FARM	MA
OUR FAMILY FARMS	MA
OAKHURST	ME
AMISH COUNTRY FARMS	NJ
VERMONT FAMILY FARMS	VT

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Price ($/ounce)	0.033	0.008	0.0001	0.0780
Brands				
National	0.548	0.498	0	1
Private Label	0.255	0.436	0	1
Local	0.197	0.398	0	1
Butterfat Content				
1%	0.238	0.426	0	1
Fat free	0.309	0.462	0	1
Whole	0.228	0.420	0	1
Container Size				
1-Gallon	0.438	0.496	0	1

Table 3. Product Characteristics by Brand Type.

Variable	Mean	Std. Dev.	Min	Max
Price				
Private Label	0.031	0.008	0.016	0.048
Local	0.036	0.007	0.016	0.051
National	0.033	0.008	0.016	0.052
Market Share				
Private Label	0.493	0.651	0.001	4.540
Local	0.007	0.009	0.000	0.054
National	0.103	0.135	0.000	1.503
1%				
Private Label	0.254	0.435	0	1
Local	0.233	0.423	0	1
National	0.233	0.423	0	1
Fat free				
Private Label	0.238	0.426	0	1
Local	0.207	0.405	0	1
National	0.379	0.485	0	1
Whole				
Private Label	0.254	0.435	0	1
Local	0.288	0.453	0	1
National	0.194	0.396	0	1
Gallon				
Private Label	0.492	0.500	0	1
Local	0.280	0.449	0	1
National	0.469	0.499	0	1

Table 4. Demand estimation Results.

	Mean Preference		Deviations			
	Mean	SE	Income	SE	Unobservable	SE
Price	-19.086***	1.656	0.613	1.670	1.692	34.923
Local	-7.725***	0.029	0.857	1.303	-2.479***	1.207
National	-6.298***	0.023	2.081***	0.186	-2.062***	0.361
Constant	-8.444***	0.066	2.170***	0.044	-0.075	0.647
Whole	0.292***	0.028				
Fat free	-0.599***	0.026				
1%	0.211***	0.028				
Gallon	0.831***	0.027				

Table 5. Simulation Results of Alternative Marketing Strategies

	Simulation 1: 10% Price cut (%)	Simulation 2: 1-gallon offering (%)
Local Milk	5.697	79.720
Private Label Milk	-0.019	-0.092
National Brand Milk	-0.023	-0.288

Table 6. Simulation Results of Alternative Marketing Strategies for Local Brands

Local Brands	Simulation 1: 10% Price cut (%)	Simulation 2: 1-gallon offering (%)
AMISH COUNTRY FARMS	8.368	119.746
BYRNE DAIRY	5.079	103.927
GUIDA'S	5.687	70.588
MARCUS	4.406	45.062
OAKHURST	4.550	56.387
OUR FAMILY FARMS	7.113	62.174
THE FARMER'S COW	7.007	96.249
VERMONT FAMILY FARMS	6.625	111.640